

Spin Filter with Polarized Superfluid: Effects of Surface and Interface

Haruo Kojima

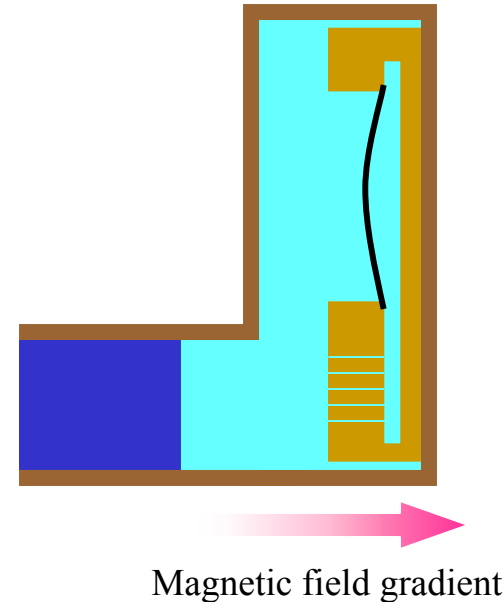
Rutgers University

DMR 0138598

The spin fluid dynamics is experimentally investigated using a spin polarized superfluid ^3He as a model system. A novel mechanical spin density detector is used to probe the nature of spin transport and relaxation effects. The results help to understand the spin transport phenomenon.

Spin Dynamics and Interface:

Earlier experiments and analyses indicated strong influence on spin relaxation by altering the "interface" between the magnetic superfluid and either another superfluid or normal fluid. A direct test on the importance of the interface is carried out by measuring the spin relaxation in an experiment which eliminates the interface altogether.



mechanical spin density detector

Spin polarized superfluid ^3He A_1 is forced to flow through spin filter. The spin flow induces pressure gradient which in turn forces the flexible film to deflect. The mechanical motion of the film is detected. The spin flow dynamics depends on the interface present in the channel.

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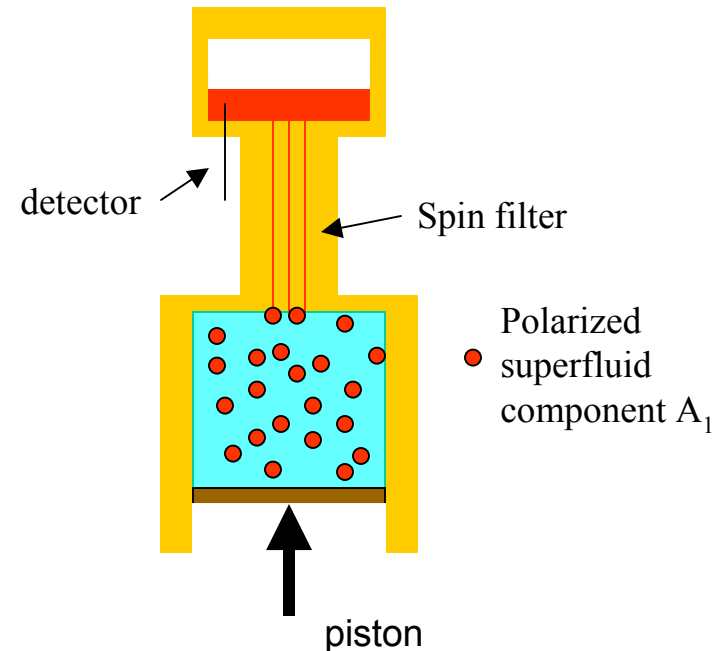
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Spin Filter for Increasing Spin Polarization:

Spin-polarized “beam” will be induced in the “ferromagnetic” superfluid ^3He A_1 phase in a new spin filter device. By pushing the A_1 fluid flow through a superleak in which only the totally spin polarized superfluid flows, a large spin polarization can be achieved. Such a spin filter experiment is proposed. A fluid state with large non-equilibrium polarization will be created and its dynamics will be studied. Experiments will be carried out on liquid ^3He cooled down to 0.003 K in magnetic fields up to 150,000 gauss.

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Proposed apparatus for increasing polarization by spin filter (polarized superfluid component is shown only for schematic illustration)

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